

Effect of Immediate Postoperative Nutritional Support on Length of Hospitalization

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This study is a retrospective review of the effect of nutritional support on duration of hospitalization in patients undergoing radical cystectomy. Thirty-five patients were randomly assigned to receive either 5% dextrose (D₅W) solution plus electrolytes or total parenteral nutrition (TPN) following operation. The assigned nutritional regimen was continued for 1 week after operation until oral intake resumed. If the patients receiving D₅W remained incapable of oral intake after 1 week, TPN was instituted. The group receiving immediate postoperative TPN had a median duration of hospitalization of 17 days, while the median duration for the group receiving 5% dextrose solution was 24 days. All other patient characteristics, such as age, sex, stage/grade of tumor, and extent of preoperative radiotherapy, were similar in the two groups. These results demonstrate that immediate postoperative institution of nutritional support reduced hospitalization time following radical cystectomy. This indicates that the routine use of 5% dextrose as postoperative nutrition should be reevaluated.

THE PREVALENCE of malnutrition in the hospitalized patient population is well known^{1,2}; it has been found to contribute to operative mortality and morbidity.³ The efficacy of nutritional support as a factor in reducing mortality and morbidity has been extensively investigated in malnourished patients undergoing major surgery⁴⁻⁹; a number of independent investigators have reported that correcting malnutrition before operation has a salutary effect on the rate of postoperative complications. Studies utilizing early postoperative parenteral nutritional support have failed to demonstrate a significant improvement in convalescence following cardiac surgery,⁹ but following esophagogastrectomy,¹⁰ early

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postoperative parenteral nutrition has been suggested to improve convalescence.

This study examines whether early institution of parenteral nutrition will affect convalescence, as measured by duration of hospitalization, in patients who have undergone radical bladder cystectomy. As part of a series of studies of the metabolic effects of total parenteral nutrition (TPN), patients were randomly assigned to receive either 5% dextrose solution or TPN in the immediate postoperative period. These patients were not malnourished prior to surgery. The duration of hospitalization was retrospectively reviewed; it was not an issue in the initial study design.

Methods

Thirty-five patients undergoing radical bladder cystectomy were admitted to the study protocol. The initial intent of the study was to examine the metabolic effects of early postoperative nutritional support. The measurements performed in the study protocols included nitrogen balance, metabolic rate, and free fatty acid turnover. These studies were carried out between 1982 and 1984. The metabolic data collected have been reported previously.¹¹⁻¹³ The patients were randomly assigned to receive either 5% dextrose or total parenteral nutrition (TPN) at 24 to 48 hours following surgery. Total parenteral nutrition was given as one of two regimens, a glucose or a lipid system.

The patients receiving total parenteral nutrition received a caloric intake of 1.3 to 1.6 times the predicted resting energy expenditure.¹⁴ Nitrogen intake varied between 280 and 400 mg/kg. The nonprotein calories were

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TABLE 1. Age, Sex, Preoperative Weight, Radiotherapy, Severity of Tumor, and Preoperative Albumin Level*

	N	Age	Sex	Weight (kg)	Radiotherapy (N)	Tumor								Preoperative Albumin (g %)
			M/F			GR			Stage					
						II	III	IV	A	B	C	D		
5% dextrose	13	67 ± 3.0	8/5	71 ± 4	7	2	7	4	3	8	2	0	3.7 ± 1	
TPN	22	66 ± 1.7	18/4	72 ± 3	11	3	11	8	7	9	3	3	3.9 ± 1	

* There are no significant differences between the two groups.

given as either glucose alone (glucose system) or a 50% mixture of glucose and lipid (lipid system). Patients receiving 5% dextrose solution received approximately 400 kcal/day of carbohydrate plus appropriate amounts of sodium and potassium chloride. In both groups, intravenous fluid therapy was continued until oral intake resumed.

Patients were not allowed oral caloric intake for the first 6–7 postoperative days; following this period, oral intake was gradually resumed. We recently reviewed the duration of hospitalization of this patient group, a parameter not considered during the performance of the study. After the period in which metabolic measurements were performed, *i.e.*, the first 7 days following surgery, the patients were discharged to routine ward care and were no longer followed by the research staff.

The course of each patient was reviewed with respect to duration of hospitalization, morbidity, and mortality.

Statistical Analysis

The effect of nutritional support on length of hospital stay was assessed, using techniques of survival analysis. In this framework, an observation is considered censored if a patient dies or withdraws from the study after the start of the nutritional regimen for reasons unrelated to his or her medical condition. In the present study, only the two patients who died from sepsis after admission to the study were held to be censored. For each group, the proportion of patients remaining hospitalized at a given time after admission was estimated, using methods of Kaplan and Meier.¹⁵ A comparison of length of hospitalization between the groups was performed using the logrank test,¹⁶ a nonparametric procedure used in survival analysis.

Results

The D₅W and TPN groups were comparable with respect to demographic characteristics, tumor stage, and grade and preoperative therapy. The mean age of the patients receiving D₅W and TPN was 67 ± 3 (SE) and 66 ± 1.7 years, respectively. The average weight was 71 ± 4 and 72 ± 3 kg, respectively. Of the 13 patients in the D₅W group, seven received preoperative radiotherapy, as did

11 of the 22 patients in the TPN group. Tumor stage and grade were similar in both groups. Preoperative albumin was 3.7 ± 0.1 in the D₅W group and 3.9 ± 0.1 in the TPN group (Table 1).

In the group receiving total parenteral nutrition, there was one significant complication, a case of wound dehiscence that necessitated hospitalization of the patient for 79 days. The median duration of hospitalization in this group was 17 days. Among the patients receiving 5% dextrose solution, there were two major complications. In both instances, intra-abdominal sepsis developed, followed by death.

Figure 1 displays Kaplan-Meier¹⁵ estimates of length of hospitalization for patients undergoing cystectomy. This data demonstrate a markedly shorter length of hospital stay for patients receiving total parenteral nutrition (median stay: 17 days) as compared to those receiving 5% dextrose (median stay: 24 days). This difference was found to be highly significant ($p < 0.002$), using the logrank test.¹⁶

The fact that patients were randomly assigned to receive either D₅W or TPN, together with the comparability of

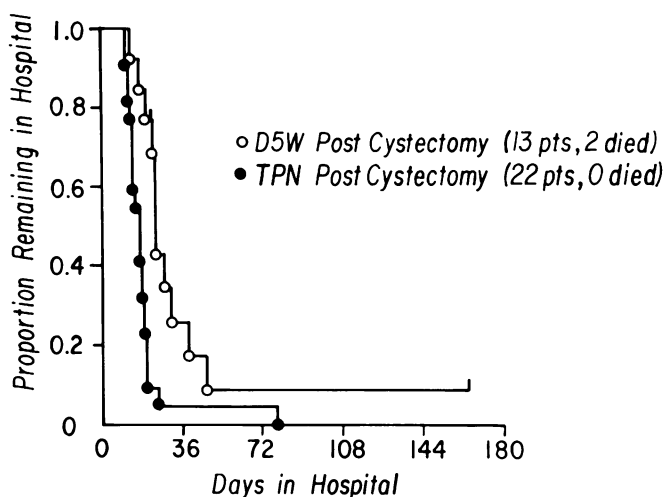


FIG. 1. The duration of hospitalization is shown. The group receiving TPN had a shorter median duration of hospitalization than the group receiving D₅W (17 vs. 24 days; $p < 0.002$). Tick mark (•) indicates last follow-up (*i.e.*, death).

patient characteristics between groups, supports the assertion that a statistically significant difference in hospital stay can be attributed to the use of TPN.

Discussion

The important role of parenteral nutrition in reversing malnutrition in patients unable to sustain oral intake is well established. The efficacy of parenteral nutrition during the immediate postoperative period in patients not previously malnourished (albumin greater than 3.5) remains unclear. Although nitrogen loss and energy requirements are increased in the perioperative period, it has not yet been established whether provision of nutrients that will correct these deficits will also improve postoperative convalescence. A number of studies have supported the concept that patients with pre-existing malnutrition have an increased mortality and morbidity following surgical procedures.¹⁷⁻¹⁹ Malnutrition has been associated with increased abdominal wound disruption, delayed gastric emptying, increased surgical infection rates, and poor wound healing.²⁰⁻²⁴

Preoperative total parenteral nutrition in patients with malnutrition, particularly when this is associated with a low albumin, is increasingly becoming a useful therapeutic intervention. Mullen et al.⁸ demonstrated a reduction in major complications with preoperative parenteral nutrition in patients with gastrointestinal carcinoma. These investigators used the prognostic nutritional index (PNI) to identify malnourished patients at risk for postoperative complications and demonstrated a reduction in operative mortality and morbidity with preoperative nutritional support. Starker et al.⁴ demonstrated that 1 week of preoperative nutritional support resulted in a reduction in complication rates when a rise in serum albumin occurred. In patients who did not show a clear rise in albumin after 1 week of nutritional support, a 3- to 5-week period of TPN was necessary to reduce complication rates.⁵

The efficacy of parenteral nutrition in the postoperative period is less well established. This is particularly true in previously well nourished patients undergoing elective surgery in whom a return to oral intake is expected within 5-7 days. Abel et al.²⁵ studied the effect of immediate postoperative parenteral hyperalimentation and found no improvement of the course of malnourished patients undergoing cardiac surgery. However, the nutritional regimen that they used supplied a daily caloric intake of only 1000 to 1400 kcal/day. Holter and Fischer²⁶ demonstrated that a combined pre- (3-day) and postoperative (10-day) period of nutritional support reduced complication rates in malnourished patients with gastrointestinal carcinoma and weight loss.

In the present study, we did not observe significant surgical complications in the D₅W group that offer an ex-

planation for the results obtained. We observed what seemed to be a reduction in the rate of resumption of activity of daily living. The data of Russell and Jeejeebhoy et al.^{27,28} offer an explanation for this phenomenon. These investigators demonstrated that hypocaloric dietary and fasting alter the contraction-relaxation characteristics of skeletal muscle and result in low frequency fatigue. This phenomenon is accompanied by structural and biochemical changes in muscle, including increased intracellular calcium, decreased enzyme levels, and Type II fiber atrophy. Impaired muscle function could be a factor in a reduced rate of activity, such as getting out of bed.

The present study demonstrates that immediate postoperative parenteral nutrition results in a reduction in hospitalization time. This occurred in patients with no significant degree of preoperative malnutrition. The study represents a small sample size and requires confirmation. It should be noted that this study was randomized but not double blind and was a retrospective review of data not collected during the actual performance of the study. Furthermore, during the course of these studies, the purpose of instituting immediate postoperative parenteral nutrition was to examine the metabolic effects of nutrients in the stress state; we did not originally intend to examine duration of hospitalization. In addition, after the period of randomized nutritional therapy and metabolic measurements, the patients were transferred out of the Surgical Metabolism Unit to routine ward care; we did not follow the course of the patients beyond this point. The data presented here were obtained by retrospective review of hospital records. So far as we could determine, the reduction in hospitalization time in the group that received early aggressive nutritional therapy was not due to individual, clearly identifiable, factors (*e.g.*, improved wound healing). Rather, it seemed that the D₅W group had a slower convalescence with a decreased rate of return of postoperative activity.

Further studies are necessary to document the application of this finding to patients undergoing other major surgical procedures.

References

1. Bistrian BR, Blackburn GL, Hallowell E, Heddle R. Protein status of general surgical patients. *JAMA* 1974; 230:858-860.
2. Bistrian BR, Blackburn GL, Vitale J, et al. Prevalence of malnutrition in general medical patients. *JAMA* 1976; 235:1567-1570.
3. Mullen JL. Consequences of malnutrition in the surgical patient. *Surg Clin North Am* 1981; 61:465-487.
4. Starker PM, LaSala PA, Askanazi J, et al. The response to TPN: a form of nutritional assessment. *Ann Surg* 1983; 198:720-724.
5. Starker PM, LaSala A, Askanazi J, et al. The influence of preoperative TPN on mortality and morbidity. *Surg Gynecol Obstet* (in press).
6. Muller JM, Brenner U, Dienst C, Pichlmaier H. Preoperative parenteral feeding in patients with gastrointestinal carcinoma. *Lancet* 1982; 1:68.

7. Holter AR, Fischer JE. The effects of perioperative hyperalimentation on complications in patients with carcinoma and weight loss. *J Surg Res* 1977; 23:31-34.
8. Mullen JL, Buzby GP, Matthews DC, et al. Reduction of operative morbidity and mortality by combined preoperative and postoperative nutritional support. *Ann Surg* 1981; 192:604-613.
9. Abel RA, Fischer JE, Buckley MJ, et al. Malnutrition in cardiac surgical patients. *Arch Surg* 1976; 111:45-50.
10. Moghissi K, Hornshaw J, Teasdale PR, Dawes EA. Parenteral nutrition in carcinoma of the oesophagus treated by surgery: nitrogen balance and clinical studies. *Br J Surg* 1977; 64:125-128.
11. Hensle TW, Askanazi J, Rosenbaum SH, et al. Metabolic change associated with radical cystectomy. *Urology* (in press).
12. Robin AP, Nordenstrom J, Askanazi J, et al. Influence of parenteral carbohydrate on fat oxidation in surgical patients. *Surgery* 1984; 95:608-618.
13. Nordenstrom J, Carpentier YA, Askanazi J, et al. Metabolic utilization of intravenous fat emulsion during total parenteral nutrition. *Ann Surg* 1982; 53:761.
14. Elwyn DH, Kinney JM, Askanazi J. Energy expenditure in surgical patients. *Surg Clin North Am* 1981; 61:545.
15. Kaplan EL, Meier P. Nonparametric estimation from incomplete observations. *Journal of the American Statistical Association* 1958; 53:457-481.
16. Mantel N, Haensel W. Statistical aspects of the analysis of data from retrospective studies of disease. *Journal of the NCI* 1959; 22: 719-748.
17. Mullen JL, Gertner MH, Buzby GP, et al. Implications of malnutrition in surgical patient. *Arch Surg* 1979; 114:121-125.
18. Buzby GP, Mullen JL, Matthews DC, et al. Prognostic nutritional index in gastrointestinal surgery. *Am J Surg* 1980; 139:160-167.
19. Studley HO. Percentage of weight loss, a basic indicator of surgical risk in patients with chronic peptic ulcer. *JAMA* 1936; 106:458-460.
20. Tweedie FJ, Long RC. Abdominal wound disruption. *Surg Gynecol Obstet* 1954; 99:41-47.
21. Efron G. Abdominal wound disruption. *Lancet* 1965; 1:1287-1290.
22. Rhoads JE, Alexander CE. Nutritional problems of surgical patients. *Ann NY Acad Sci* 1955; 63:268-275.
23. Cannon PR, Wissler RW, Woolridge RL, Benditt EP. The relationship of protein deficiency to surgical infection. *Ann Surg* 1944; 120:514-525.
24. Mecray PM, Barden RP, Raudin IS. Nutritional edema: its effect on the gastric emptying time before and after gastric operation. *Surgery* 1937; 1:53-64.
25. Abel RM, Fischer JE, Buckley MJ, et al. Malnutrition in cardiac surgical patients: results of a postoperative randomized evaluation of early postoperative nutrition. *Arch Surg* 1976; 11:45-50.
26. Holter AR, Fischer JE. The effects of perioperative hyperalimentation on complications in patients with carcinoma and weight loss. *J Surg Res* 1977; 23:31-34.
27. Russell DMcR, Leiter LA, Whitwell J, et al. Skeletal muscle function during hypocaloric diets and fasting: a comparison with standard nutritional assessment parameters. *Am J Clin Nutr* 1983; 37: 133-138.
28. Russell DMcR, Walker PM, Leiter LA, et al. Metabolic and structural changes in skeletal muscle during hypocaloric dieting. *Am J Clin Nutr* 1984; 39:503-513.